REMARKS/ARGUMENTS

In the specification, in order of your claim objections and rejections:

Claim 4 has been amended in accordance with MPEP 608.01[n]) and in compliance with the second paragraph of 35 U.S.C. 112 as directed in your Claim Objections Paragraph 4.

Claims 1 & 4 have been amended reference to your Claim Rejections Paragraph 5 & 6 to be in compliance with 35 U.S.C. 112 and MPEP 2172.01

Claims 1,2,3 & 4 have been amended in compliance with claim rejections Paragraph 7 & 8. Reference to quoted paragraphs of 35 U.S.C. 102. The proposed system is completely different in its uses, application and design to any of the sighted references although it is easy to see certain similarities in the wording one has to use.

"Detailed Description of the Invention" has been substituted for the section previously labeled "Detailed Description" and shall be placed after the Claims section in accordance with the latest preferred USPTO requirements outlined below:

"Detailed Description of the Invention
In this section, the invention must be explained along with the process of making and using the invention in full, clear, concise, and exact terms. This section should distinguish the invention from other inventions and from what is old and describe completely the process, machine, manufacture, composition of matter, or improvement invented. In the case of an improvement, the description should be confined to the specific improvement and to the parts that necessarily cooperate with it or which are necessary to completely understand the invention.

It is required that the description be sufficient so that any person of ordinary skill in the pertinent art, science, or area could make and use the invention without extensive experimentation. The best mode contemplated by you of carrying out your invention must be set forth in the description. Each element in the drawings should be mentioned in the description. This section has often, in the past, been titled "Description of the Preferred Embodiment." "

Electronic Version

Stylesheet Version v1.1.1

Description

"THE SEELEVEL". A method and apparatus for monitoring the changing levels of fluid in an enclosed tank. (an intelligent dip stick)

DETAILED DESCRIPTION

replaced with "Detailed Description of invention"

[0001] The see level method of fluid monitoring is comprised of a probe inserted into the top of the tank and an electronic interface box connected to the probe. The electronic interface box provides a direct visual bar-graph read out of the fluid level in the tank and a digital interface for process control if required.

Replaced See "Remarks & arguments"

[0002] There are many ways of measuring the fluid level in a tank, such as "looking into it", using a dip stick, a mechanical float system or an external hydraulic eye glass. The proposed system provides an inexpensive, simple solution with no moving parts and does not require access to the bottom of the tank, as in many cases, the tank is

replaced

below ground or the problem of possible leaking has to be addressed.

[0003] The proposed system works on the principle of the fluid progressively making electrical contact with conducting surfaces mounted at precise increments along the length of the probe. As contact is made at each increment, an electronic solid state switch illuminates each section of the bar-graph indicating the level of fluid in the tank. The digital data from each switch being made available on an external connector. The apparatus was originally designed for monitoring a rain water collection system but it was envisaged to have many applications including but not restricted to, water wells, septic tanks, swimming pools, water treatment and any application requiring depth or level measurement of a fluid with acceptable conductivity qualities.

replaced

SEE "Remarks & Arguments" for details & reasons.

Detailed Description of the Invention

There are many ways of monitoring the fluid level in a tank ranging from "looking into it", using a dip stick, a mechanical float system or an external hydraulic eye glass to the most sophisticated computer controlled systems with elaborate sensors. The proposed system provides an inexpensive simple solution with no moving parts, or special sensors and does not require access to the bottom of the tank, as in many cases, the tank is below ground or the problem of possible leaking has to be addressed (See FIG 1). The power supply and electronics/display box may be 300 feet from the tank being monitored (see FIG 1 & 3) and only one electronics/display box is required to serve any number of tanks to be monitored.

The key to reliable operation of the system over and above other systems available, is having a well defined on and off state for the indication of the liquid levels. This requirement was addressed in the design philosophy in the following manner:

Contamination and malfunction of the measurement sensors or transducers is eliminated by not using small intricate expensive devices at all. Instead, a relatively large surface area (9 square inches) metal plate is used to detect each measurement increment. Details of the plates are shown in FIG 8.

Further definition of the exact turn on condition is achieved by the choice of the decision making circuits for the indicators in the electronics control box. This important aspect is fully described in the section below labeled " Electronic Circuit Theory of Operation".

Electronic Circuit Theory of Operation

Refer to electronic schematic FIG 7:

PB 1 is a normally open push button switch. When a reading is to be taken, PB1 "READ" is pressed. LEDs1 through LED10 will illuminate in accordance to the fluid level in the vessel 10% through 100%. We shall use the 10 % reading circuit for the purpose of this description and the design is merely repeated for the 20% to 100% circuits.

Q1 is a PNP Bipolar Junction Transistor configured as a "normally off" switch. Under standard conditions the turn on voltage between the base and emitter connection was

found to be .745 Volts. Normally open switch WL10 and associated series resistance R31 represent the fluid level reaching conducting the 10% plate or not.

NOTE: R31 represents the resistance of the fluid, once contact is made, and is not an actual component but is included, purely for demonstration of the theory of operation.

WL10 will close when the fluid level reaches 10%. R2 was chosen as 6.8 Kohms such that .745 Volts or greater would appear at the base of Q1 if R31 was less than 61 Kohms. R21 was chosen to limit the current flowing through LED 1. R1 was included as protection from static, interference and inadvertent shorting of the probe. The values used through out, were determined theoretically using normal electronics design techniques. They were then verified on a computer simulation and proven, with extensive "in the field" experiments to determine the most practical values using standard readily available components.

The actual values of the components will vary considerably with manufacturer's tolerances and the prevailing conditions but extensive experiments have shown the components used, to provide correct performance and the best overall realization under the most demanding conditions.

R31, (representing the resistance of the fluid) will vary considerably depending on the actual fluid being measured. 61 Kohms was used as the worse case scenario in the standard design presented here. **Resistance values above this level will not provide reliable operation.** It is therefore necessary to equate this value in terms of Electrical Conductivity (EC) for the fluid in question. It is normal to express the EC of fluids in units of µS/cm or derivatives thereof as shown in table 3. The probe design provides a +20% safety factor yielding **16.3 µS/cm as the minimum electrical conductivity of acceptable fluids. Fluids with lower EC values will not work reliably with the standard version of the proposed apparatus.** (However R2 may be increased in value to accommodate lower EC values for more specific requirements).

It can be readily seen that the standard apparatus as described will function perfectly on all the common fluids it was claimed to.

The10 increments of "% Full" are made available as parallel data output at connector J1 (see FIG 7 &13).

A complete parts list of the components illustrated in FIG 7, & 14 is given in Table 1

TABLE 1

REF. No	Part	Description	Qty	Notes
R1,3,5,7,9,11,13, 15,17,19,21,22, 23,24,25,26,27, 28,29,30	7001	330 Ohm ¼ watt 5% resistor	20	
R2,4,6,8,10,12, 14,16,18,20	7002	6.8 Kohm ¼ watt 5 % resistor	10	
LED 1 – 10	7004	Red LED Everlight 5 mm	10	
PB 1	7005	Push Button N/O switch	1	
V1	7006	9 Volt Battery	1	
BC1	7009	Battery Clip Connector	1	
Q1 – 10	7007	2N3906 PNP Transistor.	10	
BD 1	7008	Circuit Board	1	Wired in accordance with FIG. 7
BX1	7010	Electronics Box	1	Part # TB-4 All Electronics Corp
FP1	7011	Front Panel	1	See FIG 14
Ancillary Materials				
		Connecting Wire	6 foot	
		Solder 60/40		

A complete parts list of the components illustrated in FIG 1 - 5 is given in Table 2

TABLE 2

REF. No	Part	Description	Qty	Notes
CP1,2,3,5,6,7,8,9,10	8001	Conduction Plate	10	Fabricated as shown in FIG.8
CR1,2,3,4,5,6,7,8,9,10	8002	Crimp Terminal	10	Ring term #22- #18 wire 8 –10 stud
LK1,2,3,4,5,6,7,8,9,10	8003	Stainless Steel Lock Washer # 10	10	
NT1,2,3,4,5,6,7,8,9,10	8004	Stainless Steel Nut # 10	10	
BLT1,2,3,4,5,6,7,8,9,10	8004	Stainless Steel Bolt ½" # 10	10	
GR1,2	8005	Grommet 9/32ID 9/16	2	Mouser Part # 5167-208
ANG1	8006	PVC angle 3/4"X.08X 6'	1	
CP1	8007	PVC Threaded End	1	
		Cap 1 ¼ "	1	
El1	8008	PVC Elbow 1 ¼"	1	
Cable assemblies	8009	Standard DB 25 Male to Male Printer Cable	1	Modified in accordance with FIG 9 &12
		3 " Aluminum Adhesive Tape. 6 foot role	1	
		PVC adhesive 8 oz	1	

Sample measurements were carried out on common materials to test their compatibility.

TABLE 3

Measurements were made on sample fluids using a proprietary conductivity meter. The instrument was calibrated using a reference standard conductivity solution of Potassium Chloride, traceable to NIST standard reference certified material.

Potasium Chloride Calibration Solution 1413 μS/cm at 25 Degrees C.

Fluid Material	Conductivity
Distilled water	3 μS/cm
Collected Rain Water	29 μS/cm
Bottled Drinking Water	53 μS/cm
Pool Water	245 μS/cm
Pond water	395 μS/cm
Chlorinated filtered Farm Tap water	454 μS/cm
Light Beer	900 μS/cm
Swimming Pool Water	1400 μS/cm
1% Low Fat Milk	1999+ μS/cm
Orange Juice from Concentrate	1999+ μS/cm
Guinness Stout	1999+ μS/cm
Burgundy Wine	1999+ μS/cm
Black Coffee	1999+ μS/cm
White Coffee	1999+ μS/cm
Household Ammonia	1999+ μS/cm
Dishwashing Detergent	1999+ μS/cm
Household Bleach	1999+ μS/cm
Septic tank sample	1999+ μS/cm

As there is such large variance in the solutions and their concentrations these measurements were intended to just give a rough idea of the relative conductivity of various common solutions. All measurements were carried out at approximately 25 Degrees C.

TABLE 4

There follows for comparison some published figures of EC (electrical conductivity) and their respective TDS (Total Dissolved salts) for naturally occurring water.

CONDUCTIVITY AND TOTAL DISSOLVED SALT VALUES

	EC (µS/cm)	**TDS** (mg/L)
Divide Lake	10	4.6
Lake Superior	97	63
Lake Tahoe	92	64
Grindstone Lake	95	65
Ice Lake	110	79
Lake Independence	316	213
Lake Mead	850	640
Atlantic Ocean	43,000	35,000
Great Salt Lake	158,000	230,000
Dead Sea	?	~330,000

Amendments to the Claims:

This listing of claims will replace all prior versions and listings, of claims in the application.

Claim 1 (amended) An apparatus for monitoring the ~~level of fluid~~ in a vessel, with no mechanical moving parts, at a remote location, providing an incremental display and data output for process control, if required.

Claim 2 (amended) An apparatus according to claim 1 wherein the system will operate in a remote location without a local source of power.

Claim 3 (amended) An apparatus according to claim 1 wherein the probe shall be custom made to individual requirements and the display shall be in 10, 10% increments of full capacity. The display/electronics box may be an integral part of the probe assembly or connected to the probe via a standard DB25 cable in excess of 300 feet if required.

Claim 4 (amended): An apparatus in any one of claims 1,2, or 3 wherein the cost of production would be inexpensive.

Electronic Version

Stylesheet Version v1.1.1

ON File at USPTO 04/09/2004 mail room date

Claims

[c1] A method of monitoring the level of fluid in a tank with no mechanical moving parts at a remote inaccessible location, providing, digital readout on a bar-graph display and data output for process control if required.

replaced

[c2] A method according to claim 1 wherein the system will operate in a remote location from a standard 9 Volt 500mH battery for over two years with normal use or powered from a standard power source if available.

replaced

[c3] A method according to claim 1 where the probe may be custom made to individual requirements and the "read out" displayed in gallons, feet, or whatever units are appropriate. The electronic box may be made an integral part of the probe assembly or connected to the probe via a standard DB25 cable in excess of 100 feet if required.

replaced

[c4] A method according to claim 1,2 and 3 wherein the cost of production would be inexpensive.

replaced

See "Remarks/Arguments" for reasons

& see "Amendments to Claims"

Both of these are on file at USPTO

Amendments to the Drawings:

FIG 1 & FIG 2, that were deemed to be inadequate in the original submission, have been amended to the following set of drawings and will replace all prior versions in the application

Brief Description of the Several Views of the Drawing

Note: Use the block diagram of FIG. 2 to reference the sub assemblies, their drawings and FIG. Numbers.

FIG. 1 is a diagram of the embodiment of a typical system as used on the prototype and preproduction version. A 5 foot deep, below ground tank was used for this purpose and for making drawings FIG. 3 – FIG.5.

FIG. 2 is a block diagram showing the complete system and its components referencing the appropriate assemblies and their drawings.

FIG. 3 shows the mechanical detail of the integrated assembly. Inner probe, outer sheath, electronics box and interconnecting cables.

FIG. 4 shows the mechanical details of the outer sheath

FIG. 5 shows the mechanical details of the inner probe.

FIG. 6 shows how the design would be changed for the embodiment of a 4-foot deep system.

FIG.7 is a complete electronic schematic of the electronics box.

FIG 8 shows the detail of the plate connection and associated parts.

FIG 9 shows the detail of the probe connector assembly 007.

FIG. 10 shows the detail of interconnecting cable assembly 003

FIG. 11 shows the mechanical assembly of the display electronics box.

FIG 12 shows the detail of display electronics box interconnecting cable assembly 004

FIG. 13 shows connection detail of Optional Data Output J1..

FIG. 14 shows the display electronics box front panel

FIG 15 shows the drilling data of the front panel.

FIG. 16 shows a photograph of the Electronics Display Box pre production version.

FIG. 17 shows a photograph of the probe assembly (5 foot version).

Table 1: A complete parts list of the components illustrated in FIG 7, & 14 is given in Table 1.

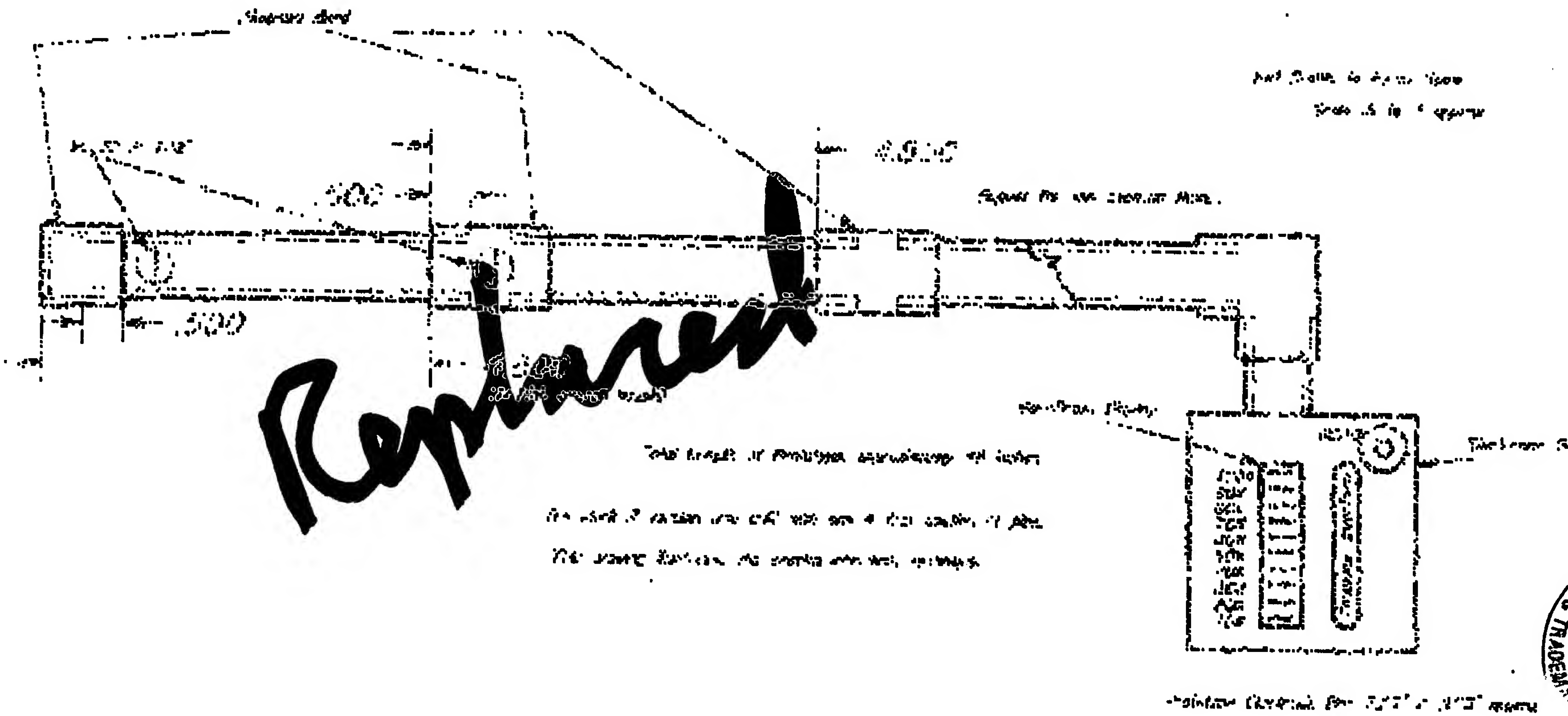
TABLE 2: A complete parts list of the components illustrated in FIG 1 - 5 is given in Table 2

TABLE 3: Sample measurements were carried out on common materials to test their compatibility. The results are shown in Table 3.

TABLE 4: Table 4 was included for comparison of some published figures of EC (electrical conductivity) and their respective TDS (Total Dissolved salts) for naturally occurring water.

This is a copy Drawing 1 (Downloaded from USPTO as mail room date 04/09/2004)
to be replaced with Drawings labelled Fig 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16 & 17.

FIG 1

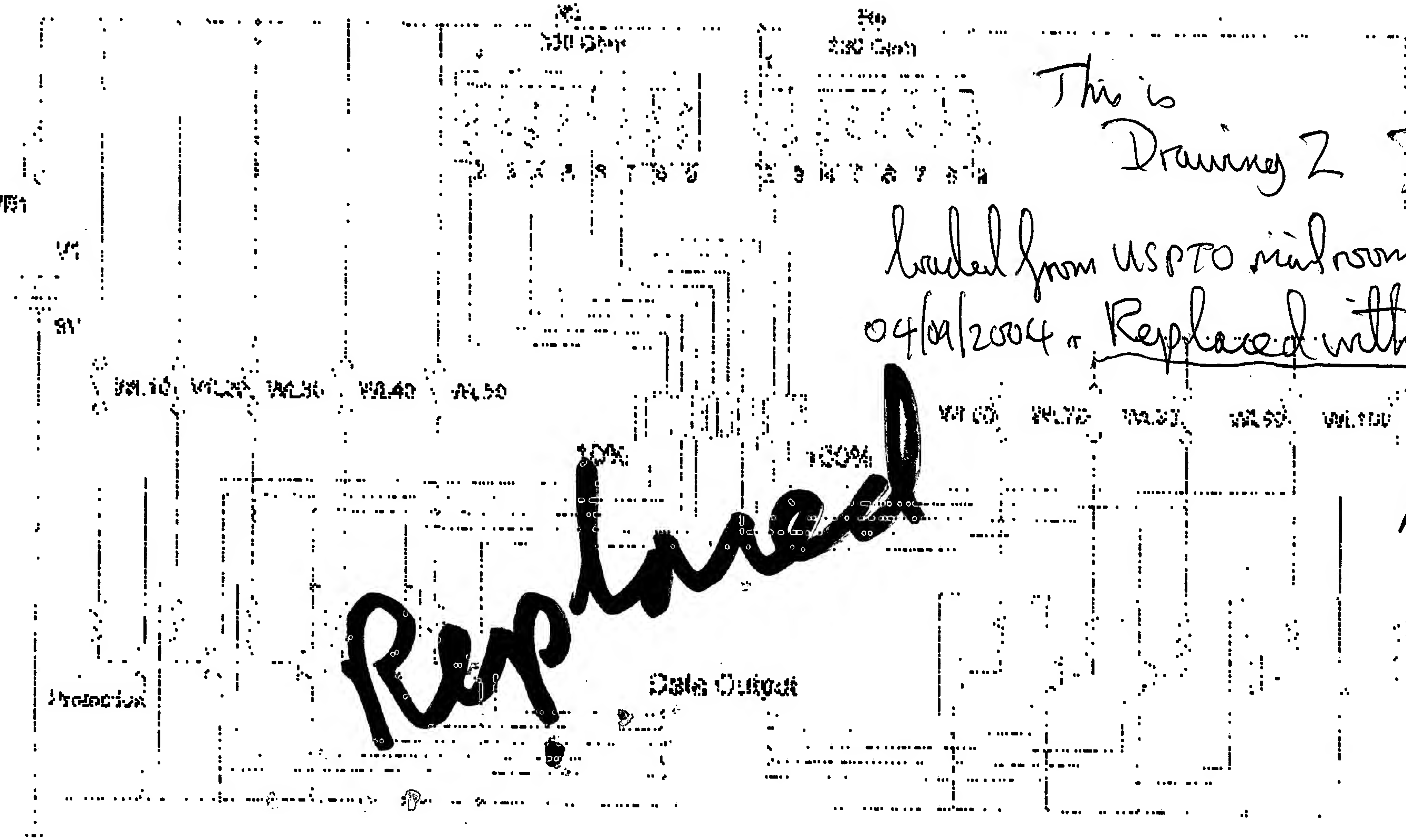


BEST AVAILABLE COPY

This is Drawing 2 Down loaded from USPTO mailroom date 04/09/2004 . Replaced with Fig 7

Fig 2

Replaced



WL 10 through 100 and their associated resistors represent the water level contacts 10% through 100%

The prototype employed 330 ohm protection resistors in series with the contacts as shown wired through a DB25 connector (see separate drawing). The prototype used the switched +VCC as the cable shield and GND for screening. +VCC Floating.

Designed by:	Checked by:
Approved by:	Date: FEB 20, 2004
Sheet 1 of 1	